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# PATENT ABSTRACTS OF JAPAN

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## (54) DISCHARGE LAMP LIGHTING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To make starting voltage of a discharge lamp lighting device asymmetric, reduce starting voltage as viewed as a peak-to-peak voltage value while starting performance is kept, and make voltage resistance of a component low and the miniaturization by setting the starting voltage being applied to an electrode on the low resistivity side and the starting voltage being applied to an electrode on the high resistivity side in a specific relation. SOLUTION: Starting voltage being applied to an electrode on the low resistivity side is set in V1 to earthed voltage, starting voltage being applied to an electrode on the high resistivity side is set V2 to the earthed voltage, and starting voltage is applied so as to have the relation of |V1|>|V2|. Preferably, at the starting of a lamp, a DC component is superimposed on AC lamp voltage, height of the starting voltage is alternately varied to the ground surface, the starting voltage is corrected according to the using time of the lamp, the frequency at the start of the lamp is made higher than that in the stable lighting of the lamp, and the shapes of bases at opposite ends of the lamp are made asymmetric.

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CLAIMS

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[Claim(s)]
[Claim 1] In the electric-discharge lamp lighting device which it has [ lighting device ] resistance along the direction of a discharge way in a tube wall, and the resistance distribution sees [ lighting device ] from a lamp longitudinal direction core, and makes an unsymmetrical lamp turn on with alternating voltage The electric-discharge lamp lighting device characterized by impressing starting voltage so that it may become |V1|>|V2| if resistivity sets to V1 starting voltage impressed to the electrode of a small side to touch-down potential and sets to V2 starting voltage with which resistivity is impressed to the electrode of a large side to touch-down potential.
[Claim 2] The electric-discharge lamp lighting device according to claim 1 characterized by providing a means by which make superimpose a dc component at the time of lamp starting, and it is impressed by the lamp voltage of an alternating current at it.
[Claim 3] The electric-discharge lamp lighting device according to claim 1 characterized by providing a means to change the height of starting voltage in alternation to a grand side.
[Claim 4] The electric-discharge lamp lighting device according to claim 1 characterized by providing a means to amend starting voltage according to the time of a lamp.
[Claim 5] The electric-discharge lamp lighting device according to claim 1 characterized by making the frequency at the time of lamp starting higher than the frequency at the time of lamp stability lighting.
[Claim 6] the mouthpiece of lamp both ends -- the electric-discharge lamp lighting device according to claim 1 characterized by making a configuration unsymmetrical.

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the electric-discharge lamp lighting device which carries out starting lighting of the fluorescent lamp with a conductive coat with alternating voltage.
[0002]
[Description of the Prior Art] Generally the consideration which a electric-discharge lamp lighting device restricts the output to a load for safety at the time of the abnormalities at lamp no-load and lamp incorrect insertion, a lamp filament open circuit, the time of the lamp end of life, etc., or is stopped is made. It receives unusually and the electronic formula stabilizer which consisted of especially electronic parts is implementing cures against protection, such as a quenching function and an intermittent oscillation function, often [ above ].
[0003] Drawing 20 is the circuit diagram of the conventional example (JP,9-153397,A). The rectifier DB with which this circuit carries out full wave rectification of the AC power supply, and the capacitor C2 connected to the outgoing end of Rectifier DB, The series connection of the switching elements Q1 and Q2 connected to the both ends of a capacitor C2, The series connection of the diodes D1 and D2 connected to the both ends of a switching element Q2, The series connection of the inductor L1 and smoothing capacitor C1 which were connected to the both ends of a switching element Q1 through diode D2, While consisting of series connection of the capacitor C3 connected to the both ends of a switching element Q2, an inductor L2, and the primary coil of a transformer T1 When the switching elements Q1 and Q2 of two stones repeat turning on and off by turns, it is the electric-discharge lamp lighting device which supplies the high-frequency power of the alternating current to the electric-discharge lamp 2 which is a load through the secondary coil of a transformer T1, and the capacitor C4 for a dc-component cut. moreover, in the circuit which consists of an inductor L1, a smoothing capacitor C1, and diodes D1 and D2 By supplying a current in the path of AC-power-supply -> rectifier DB-> inductor L1 -> smoothing capacitor C1 -> diode D2 -> switching element Q2 -> rectifier DB-> AC power supply at the time of ON of a switching element Q2 If a smoothing capacitor C1 is made to generate the charge electrical potential difference of a predetermined value and the output voltage of Rectifier DB declines from the charge electrical potential difference of a smoothing capacitor C1, the charge electrical potential difference of a smoothing capacitor C1 will serve as a power source of the inverter circuit which consists of a switching element Q1 and Q2 grade. That is, the circuit which consists of an inductor L1, a smoothing capacitor C1, and diodes D1 and D2 operates as the so-called partial smooth power source.
[0004] Moreover, the resistance R1 by which parallel connection was carried out among the non-power-source side edge children of a electric-discharge lamp 2, and resistance R2 and resistance R3 by which parallel connection was carried out to the both ends of switching elements Q1 and Q2 through the filaments f1 and f2 of a electric-discharge lamp 2, Resistance R1-R3 and IC1 which outputs a signal for the electrical potential difference determined by the filaments f1 and f2 of a electric-discharge lamp 2 to an oscillator circuit IC 2 as compared with reference voltage Vref are formed, and it has the

configuration which performs no-load detection and filament open-circuit detection.
[0005] The actuation of this detector is as follows. Since a current flows from a power source in the path of the filament f2 -> resistance R2 -> resistance R3 of the filament f1 -> resistance R1 -> electric-discharge lamp of a electric-discharge lamp at the time of wearing of a normal electric-discharge lamp The electrical potential difference of resistance R1-R3 and the resistance R3 determined by the filaments f1 and f2 of a electric-discharge lamp rises, it is setting up so that it may exceed reference voltage Vref in this condition, and IC1 outputs the signal of a low level to an oscillator circuit IC 2. An oscillator circuit IC 2 continues oscillation actuation of switching elements Q1 and Q2 in response to this signal. On the other hand, if at least one side of the filaments f1 and f2 of un-equipping or a electric-discharge lamp is disconnected by the electric-discharge lamp, since the current path to the above resistance R2 and R3 will be intercepted, the electrical potential difference of resistance R3 falls to abbreviation 0, that is, is less than the predetermined electrical potential difference Vref, and IC1 outputs a high-level signal to an oscillator circuit IC 2. An oscillator circuit IC 2 suspends oscillation actuation of switching elements Q1 and Q2 in response to this signal for protection of passive circuit elements, and performs quenching of switching elements Q1 and Q2. Here, if the charge shall be charged by the capacitor C4 for a dc-component cut, the current path of the secondary coil -> resistance R2 -> resistance R3 -> power source of the capacitor C4 -> transformer T1 for a power-source -> dc-component cut does not exist in it.
[0006] As mentioned above, in this conventional example, DC component by which the partial pressure was carried out through filament resistance and the resistance connected to the lamp at juxtaposition as a means to detect abnormal conditions, such as no-load [ of a lamp ] and an open circuit of a filament, has judged whether it is more than reference voltage. A filament disconnects this no-load detection method through both the filaments of a lamp, and effectiveness is very much to detect that DC current path was intercepted, and, generally it is used.
[0007] Drawing 21 shows the voltage waveform of a preheating and the lamp both ends at the time of making the light start and switch on for the lamp in the circuit of the conventional example. The electrical potential difference of the lamp both ends in this circuit has the description in the point that the electrical potential difference from a grand side serves as positive/negative asymmetry so that more clearly than drawing 21 . Since the oscillation electrical potential difference of an inverter is always overlapped on DC component for no-load detection at the time of a preheating, starting, and lighting, if lamp voltage of V0-p+ and a negative side is made into V0-p- for the lamp voltage by the side of forward [ of DC electrical potential difference on the basis of a ground plane ], the relation of |V0-p+|>|V0-p-| will be materialized inevitably. thus, the starting voltage of a lamp -- middle point touch-down -- receiving -- positive/negative -- when unsymmetrical, it is necessary to set up highly the starting voltage when seeing on the electrical potential difference Vpp from a peak (forward) to a peak (negative)
[0008] On the other hand, as for the latest lamp, starting voltage tends to rise for efficient-izing. That is, in order to make the latest efficient fluorescent lamp turn on satisfactory, ballast must impress an electrical potential difference low enough at the time of a preheating to a lamp, and must impress a very high electrical potential difference to a lamp at the time of starting. Generally, when starting voltage is high (i.e., if the oscillation electrical potential difference of ballast is high), there is an inclination for the electrical potential difference impressed at the time of a preheating to also become high. Therefore, this condition is narrowing the design tolerance of ballast and there was a problem of leading to a cost rise as a result.
[0009] This reason is explained below. First, the electrode of a fluorescent lamp is explained. This electrode attaches the matter called an emitter to a thin double coil-like (or triple coiled form) tungsten wire. This matter is for making electron emission easy to carry out, and current use of the barium oxide (a work function is low) etc. is carried out. the way of making carries out dipping of the thing of the shape of a slurry of a barium carbonate to an above-mentioned coiled form tungsten wire, and dries -- making -- lamp exhaust air -- the barium oxide is formed by heating in process -- making ($BaCO_3$ -> $BaO+CO_2$ : removal out of [ Exhaust air $CO_2$ is in process. ] a lamp) -- it says. The adhesion situation

to the tungsten wire of the emitter matter attached to the electrode so that he can understand also from this process is not so powerful.
[0010] Next, the electron emission device of this electrode is explained. The current emitted from an electrode is expressed with a degree type.
I=alpha*T 2 *exp(- beta/T) *exp (rootE/T)
alpha: Constant beta related to an electrode material: Constant T related to an electrode material: Electrode temperature E: Field strength of the cathode drop section (it is related to a cathode drop electrical potential difference)
[0011] As shown also in this formula, the discharge current is determined on electrode temperature and a cathode drop electrical potential difference. If electrode temperature is low that is, in order to supply a current at the time of starting as a preheating is inadequate, a cathode drop electrical potential difference will rise. A rise of a cathode drop electrical potential difference increases the kinetic energy of ion (supplied by the cathode drop electrical potential difference) in case ion collides to an electrode. It becomes impossible for this reason, to disregard the effect of the ion bombardment to an electrode.
[0012] As mentioned above, how to the electrode of an emitter to attach is not so strong. Therefore, if a cathode drop electrical potential difference rises, an emitter will exfoliate from a tungsten wire by the impact of the ion. There is a problem that this becomes a short life in order to decrease the emitter currently attached to the tungsten wire while causing the melanism of the electrode section of a lamp. In order to prevent this, it is required to warm enough, before putting an electrode into operation.
[0013]
[Problem(s) to be Solved by the Invention] Drawing 17 shows resistance distribution of the lamp which has each lamp manufacturer's conductive coat. Resistance distribution of a conductive coat looks at the lamp by A company make and B company from the location based on lamp longitudinal directions, it is greatly unsymmetrical, and the resistance of the tubing edge by the side of the manufacturer mark on the front face of a lamp is low, and the resistance of the tubing edge of the lamp of a mark and the opposite side is very high. Resistance distribution of a conductive coat looks at the lamp by C company make and D company from the location based on lamp longitudinal directions, it is asymmetry a little, and its resistance of lamp both the tubing edge is high, and it serves as distribution with a low center section. As for such a difference, each company originates in the difference in a production process. Although the lamp with a conductive coat has a difference by each manufacturer, it can be said that resistance distribution is unsymmetrical seen from a longitudinal direction core. With such a lamp, starting voltage serves as positive/negative asymmetry.
[0014] however -- the copper-iron stabilizer of a conventional type -- starting voltage -- positive/negative -- an unsymmetrical lamp -- receiving -- positive/negative -- there was no means to control whether it is made to start with which polarity, and since it was the sine wave of a commercial frequency, positive/negative [ say / |V0-p+|=|V0-p-|=| lamp starting voltage | ] needed to impress the big electrical potential difference of the amplitude to the lamp inevitably.
[0015] This invention is made in view of such a point, and the place made into the purpose is to reduce the starting voltage seen with peak pair peak value, unsymmetrical-izing starting voltage of a electric-discharge lamp lighting device to a lamp with unsymmetrical starting voltage, and maintaining startability ability.
[0016]
[Means for Solving the Problem] In the electric-discharge lamp lighting device which it has [ lighting device ] resistance along the direction of a discharge way in a tube wall, and the resistance distribution sees [ lighting device ] from a lamp longitudinal direction core, and makes an unsymmetrical lamp turn on with alternating voltage in order to solve the above-mentioned technical problem according to this invention If resistivity sets to V1 starting voltage impressed to the electrode of a small side to touch-down potential and sets to V2 starting voltage with which resistivity is impressed to the electrode of a large side to touch-down potential, it will be characterized by impressing starting voltage so that it may become |V1|>|V2|.
[0017]

[Embodiment of the Invention] (Example 1) The 1st example of this invention is explained. the electrode of a side with the low resistance component of a lamp with a conductive coat with resistance distribution of the direction of a discharge way unsymmetrical [ the description of the 1st example ] -- positive/negative -- it is impressing starting voltage V0-p of the higher one among unsymmetrical starting voltage, and reduction of the starting voltage Vpp of the peak pair peak value impressed to lamp both ends is aimed at.

[0018] Drawing 1 is the explanatory view of the example 1 of this invention, and shows microscopically the lamp voltage at the time of making the direct current voltage VDC of 50V superimpose on the RF alternating voltage on the basis of a ground plane, and being impressed by it. If lamp voltage of V0-p+ and a negative side is made into V0-p- for the lamp voltage by the side of forward [ of direct current voltage VDC ], it will become |V0-p+|>|V0-p-|. ambient temperature -- ordinary temperature and a lamp -- with a conductive film -- in the conditions of lamp FLR40S36, when a side with the small resistance per unit length near [ one ] the electrode was connected with a forward side, in the lamp voltage by the side of forward, the lamp voltage of |V0-p+|=500V and a negative side turned on the lamp by |V0-p-|=400V. Therefore, the electrical-potential-difference difference to a negative peak from a forward peak brought a result of Vpp=|V0-p+|+|V0-p-|=900V.

[0019] Drawing 2 is the explanatory view of the example of a comparison to this invention, and shows the lamp voltage of a RF symmetrical with a line microscopically on the basis of a ground plane. If lamp voltage of V0-p+ and a negative side is made into V0-p- for the lamp voltage by the side of forward, it will become |V0-p+|=|V0-p-|. ambient temperature -- ordinary temperature and a lamp -- with a conductive film -- in the conditions of lamp FLR40S36, whichever it connected [ of a negative side ] the side with the small resistance per unit length near [ one ] the electrode the forward side, the lamp voltage of |V0-p+|=500V and a negative side turned on the lamp for the lamp voltage by the side of forward by |V0-p-|=500V. Therefore, the electrical-potential-difference difference to a negative peak from a forward peak brought a result of Vpp=|V0-p+|+|V0-p-|=1000V.

[0020] As mentioned above, in the example of drawing 1 which carried out this invention to the example of a comparison of drawing 2 which does not carry out this invention, when the electrical-potential-difference difference Vpp to a negative peak from a forward peak was compared, starting voltage mitigation of 100V was able to be carried out in total.

[0021] Here, drawing 14 shows the structure of a lamp with a conductive coat. The Nesa membrane which is a conductive coat is prepared in the inside of a glass tube, and the fluorescent substance is applied to it through the protective coat on it. Drawing 15 shows the condition before lighting of a lamp with a conductive coat with a false model. In a lamp, the lamp with a conductive coat generates the plasma, forms a discharge way, and makes a lamp turn on by carrying out the charge up of the electron one after another through a conductive coat from a two-poles side at the time of starting voltage impression. If the conductive coat of a lamp with a conductive coat is distributed over homogeneity, the resistance per unit length will become equal, but if a conductive coat is uneven in the whole tubing and a difference is in the resistance per unit length, the partial potential difference will be produced. When the A company make of drawing 17 and the resistance of a B company a uni directional like make are very large, a big potential difference part occurs in a lamp, and an electron especially becomes easy to fly to the location where the potential difference per unit length is high.

[0022] Starting voltage which will be impressed to the electrode of a side with the small resistivity of a conductive film if the above thing is summarized is set to V1 to touch-down potential, and if starting voltage impressed to the electrode of a side with large resistivity is set to V2 to touch-down potential, reduction of the starting voltage when seeing with peak pair peak value can be aimed at by carrying out the relation |V1|>|V2|.

[0023] Generally, as for a stabilizer, the stress at the time of starting becomes the tightest to a component part. Therefore, proof-pressure mitigation of various component parts is attained by controlling starting voltage. Moreover, if ambient temperature shifts to a low temperature side, since the starting voltage for turning on a lamp will become high, this inclination becomes remarkable.

[0024] In this example, especially the circuitry of a stabilizer does not have the need of asking and is

altogether applied to what is carried out due to above-mentioned |V1|>|V2|. Moreover, about the time of lighting, if the above-mentioned dc component VDC is lessened, a peak factor is improvable. Moreover, although the electric-discharge lamp lighting device which generates a RF explained this example, it can acquire the same effectiveness also in the lighting device of a **** form which operates with commercial frequency.

[0025] (Example 2) The 2nd example of this invention is shown in drawing 3 . The end of the lamp 2 with a conductive film is connected to one outgoing end of the electric-discharge lamp lighting device 1 connected to AC power supply AC, and the other end of the lamp 2 with a conductive film is connected to the outgoing end of another side of the electric-discharge lamp lighting device 1 through Switch SW by usually falling on the terminal side with which the switch SW of the starting amendment circuit 3 was illustrated at the time of lighting. It falls on the terminal side of that the switch SW of the starting amendment circuit 3 was illustrated at the time of starting, and the opposite side, and has the composition that direct current voltage VDC and Resistance R are connected to a lamp 2 at a serial. Electric-discharge lamp lighting-device 1 itself impresses the output of the sine wave which is not superimposed on a dc component to a lamp 2.

[0026] The direction where a lamp 2 is connected is made into the direction where it is superimposed on direct current voltage VDC at a side with the small resistivity of a conductive film so that the relation of an example 1 may be realized. Incidentally, in our investigation, the asymmetry of A company and B company shown in drawing 17 was large, and the side which has printed the lamp mark was a side with the small resistivity of a conductive film. The above-mentioned configuration enables it to reduce starting voltage concretely.

[0027] Drawing 1 and drawing 2 explain actuation of this example. Drawing 2 is the wave of lamp voltage at the time of starting when not superimposing DC component. It is |X1|=|X2|=500V among drawing, and the peak pair peak value of starting voltage is set to Vpp=1000V. On the other hand, drawing 1 is the wave of lamp voltage at the time of starting when this example is overlapped on direct-current-voltage VDC=50V. It is |X1|=|X2|=400V and |X3|=|X4|=450V among drawing, and the peak pair peak value of starting voltage is set to Vpp=900V. Thus, starting voltage was able to be reduced by 100V with peak pair peak value by making the direct current voltage VDC of 50V superimpose.

[0028] (Example 3) Drawing 4 shows the 3rd example of this invention. This example adds the configuration which makes resistance R2 of the basic component circuit stated to the conventional example (JP,9-153397,A) variable resistance Rx, and makes variable resistance Rx adjustable by the timer circuit IC 3. The resistance of variable resistance Rx is made into the proper resistance which can detect the existence of a filament at the time of a preheating and lighting, and at the time of starting voltage impression, it controls the value of variable resistance Rx by the timer circuit IC 3 so that the relation of above-mentioned |V1|>|V2| is realized. It is made into the filament open-circuit detection prohibition section at coincidence at the time of this starting voltage impression. Since the configuration of the timer circuit IC 3 may use a general-purpose article and the time constant of CR is used, detailed explanation is omitted.

[0029] (Example 4) It is necessary to specify the direction where a lamp is connected by the catalog or specification, and a limit occurs in the use by the side of a user in the above-mentioned examples 1-3. Then, although the path of insertion of a lamp is specified and it drops off as the 4th example of this invention, a means by which essence of this invention can be carried out is described.

[0030] Drawing 5 shows macroscopically the starting voltage impressed to a lamp, and shows change of the envelope of high-frequency voltage. The starting period for putting a lamp into operation is divided into A section and B section. If starting voltage is seen with zero pair peak value, in A section, it is considering as |V0-p+|<|V0-p-| in |V0-p+|>|V0-p-| and B section. When it sees with peak pair peak value, in A section, it is Vpp (A). In =|V0-p+|+|V0-p-| and B section, it is Vpp (B). It is =|V0-p+|+|V0-p-| and is Vpp (A). = Vpp (B) It is carrying out.

[0031] According to this example, since the electrical potential difference of required zero pair peak value is given, the lamp with a conductive film which was not turned on with the directivity of a lamp in A section can also be put into operation in B section. Effectiveness which was stated in the example 1

can be acquired by this.
[0032] As a means which changes starting voltage in A section and B section, the means which changes the direction of the direct current voltage VDC of drawing 3 , for example can be considered. Moreover, as a development form of this example, the sequence of A section and B section is replaced, or there is a configuration in which A section and B section appear repeatedly during a starting period.
[0033] (Example 5) The 5th example of this invention is shown in drawing 6 . Drawing 6 shows macroscopically the starting voltage impressed to a lamp, and shows change of the envelope of high-frequency voltage. The difference from an example 4 is the point of there being nothing, attaching a smooth change and replacing the forward direction and the negative direction, in changing the height of starting voltage gradually.
[0034] The starting voltage which looked at the electrical potential difference for putting a lamp into operation with zero pair peak value when it decomposed into A section immediately after starting voltage impression, B section in the middle of starting voltage impression, and C section in front of starting voltage impression termination In A section, it becomes |V0-p+|<|V0-p-| in |V0-p+|=|V0-p-| and C section in |V0-p+|>|V0-p-| and B section. When it sees with peak pair peak value, in A section, it is Vpp (A). =|V0-p+|+|V0-p-|, In B section, it is Vpp (B). In =|V0-p+|+|V0-p-| and C section, it is Vpp (C). It is =|V0-p+|+|V0-p-| and is Vpp (A). = Vpp (B) = it is referred to as Vpp (C). Thereby, effectiveness which was stated in the example 1 can be acquired.
[0035] The case where change of the starting voltage by this means is seen microscopically is described below. Drawing 7 looks at microscopically the lamp voltage at the time of starting when a lamp is overlapped on DC component. Bias is carried out to the forward side from Ground (touch-down potential) by DC component. In this case, it is |X3|=|X4| and becomes the relation of |X3|+|X4|>|X1|+|X2|.
[0036] Drawing 8 looks at microscopically the lamp voltage at the time of making switching duty of an inverter into imbalance. Since the approach of making switching duty imbalance is a general approach for carrying out modulated light lighting, explanation is omitted. Here, imbalance control of switching duty is performed so that bias may be carried out to a negative side from Ground. In this case, it becomes |X5|>|X1|. It is Vpp (A) about the peak pair peak value at this time. It carries out.
[0037] Drawing 9 looks at microscopically the lamp voltage at the time of combining DC component superposition of drawing 7 , and the effectiveness of imbalance control of the switching duty of drawing 8 . Imbalance control of switching duty is performed so that bias may be carried out to a forward side by DC component superposition from the Ground side and bias may be carried out to a negative side from Ground. Consequently, it becomes the relation of |X6|<|X7| and |X6|+|X7|=|X1|+|X2| by amending each other mutually. It is Vpp (B) about the peak pair peak value at this time. It carries out.
[0038] Drawing 10 looks at microscopically the lamp voltage at the time of enlarging further imbalance control of the switching duty in drawing 9 , and considering as |X6|<<|X7|. In this case, DC component of drawing 7 can be negated and the relation of |X1|<|X8| can be further made by amending to hard flow. It is Vpp (C) about the peak pair peak value at this time. It carries out.
[0039] If it controls so that the period A of drawing 7 , the period B of drawing 9 , and the period C of drawing 10 arise in order, it will be starting voltage Vpp like drawing 6 (A). Vpp (B) Vpp (C) It is obtained. Thus, if imbalance control of switching duty is used, since control is also easy, as a means which smooths change of starting voltage, practicality is very high [ change of duty ].
[0040] By smoothing alternation of starting voltage impression, the dV/dt property of the capacitor especially in connection with starting of the component part of a electric-discharge lamp lighting device can be improved, and a miniaturization becomes still more possible. About this example as well as an example 4, the sequence of A section and C section may be replaced, or a configuration in which A section and C section appear repeatedly during a starting period may be used.
[0041] (Example 6) The 6th example of this invention is shown in drawing 11 . Drawing 11 shows macroscopically the starting voltage impressed to a lamp. When a lamp does not light up by preheating starting once, the difference from examples 4 and 5 considers as the intermittent oscillation which prepares the pause section, and is characterized by taking high V0-p of last time and hard flow by the

following preheating starting mode. As shown in drawing 11 , the lamp starting voltage of idle-period before and the back is changed in A section and B section. If starting voltage is seen with zero pair peak value, in A section, it is considering as |V0-p+|<|V0-p-| in |V0-p+|>|V0-p-| and B section. When it sees with peak pair peak value, in A section, it is Vpp (A). In =|V0-p+|+|V0-p-| and B section, it is Vpp (B). It is =|V0-p+|+|V0-p-| and is Vpp (A). = Vpp (B) It is carrying out.

[0042] According to this example, since a V0-p electrical potential difference required in the next B section is given through an idle period and a pre-heating period, the lamp with a conductive film which was not turned on with the directivity of a lamp in A section can also be put into operation. Effectiveness which was stated in the example 1 can be acquired by this.

[0043] As a means which changes starting voltage in A section and B section, the means which changes the direction of the direct current voltage VDC of drawing 3 , for example can be considered. Moreover, after replacing the sequence of A section and B section or repeating A section several times as a development form of this example, a configuration which combined the configuration or examples 4 and 5 which shift at B section is possible.

[0044] (Example 7) The 7th example of this invention is described below. The component of the conductive coat of the lamp with a conductive coat stated in the examples 1-6 is using chlorination tin as the main raw material. As for the condition of this chlorination tin, a resistance component tends to become low by ambient temperature and electric field. That is, immediately after the lamp beginning of using, if extremely unsymmetrical resistance distribution like A company of drawing 17 and B company also continues and uses a lamp, as shown in drawing 12 , it will change to almost flat resistance distribution. Then, the oscillation electrical potential difference of a electric-discharge lamp lighting device also needs to enlarge the difference of V0-p+ and V0-p- according to the time of a lamp. It is because the location where a resistance component is high is lost partially, electric-field concentration is carried out and it is hard coming to carry out the charge up of the electron, since a difference is lost to the resistance distribution as which this regarded the lamp after long duration use from the core of a longitudinal direction.

[0045] Change of the starting voltage after the prolonged progress by this example is shown in drawing 13 . In A section immediately after the lamp beginning of using, it considers as |V0-p+|>|V0-p-|, and is considering as |V0-p+|>>|V0-p-| in B section after prolonged use. When it sees with peak pair peak value, in A section, it is Vpp (A). In =|V0-p+|+|V0-p-| and B section, it is Vpp (B). It is =|V0-p+|+|V0-p-| and is considering as Vpp(A) =Vpp(B). Thus, as a means to change only the imbalance from a grand side, a means which was mentioned in the example 5 is effective, without changing Vpp of starting voltage.

[0046] Moreover, as a means to detect the time of the above-mentioned lamp, it is effective to see change of lamp voltage. Since the time of a lamp follows on passing and goes up, lamp voltage can detect the time of a lamp by seeing change of lamp voltage. Moreover, a timer circuit may detect the time of a lamp. Positive lamp lighting also in consideration of the time of a lamp is expectable with this example.

[0047] (Example 8) The 8th example of this invention is described below. When putting a lamp with a conductive coat into operation, it has been said that the charge up to a conductive coat is important. The equal circuit of a lamp with a conductive coat is shown in drawing 16 . The electrode and the conductive coat are combined by the capacitor of distributed capacity so that it may understand from this equal circuit. It is known that this coupling capacitor has the capacity of several 10 nF extent. The electron which jumped out of the electrode is influenced to the frequency impressed to a electric-discharge lamp in order to fly to a conductive coat through this coupling capacitor. That is, the low frequency of the impedance of this coupling capacitor is higher, and it can make it low by the RF. Therefore, since the one where a frequency is higher can reduce the impedance of a coupling capacitor at the time of lamp starting, an electron is effectively chargeable to a conductive coat. However, at the time of the usual stable lighting, little direction of the bypass current to the conductive coat which does not contribute to luminescence of a lamp is good, judging from the field of lamp efficiency.

[0048] When the frequency at the time of lamp starting will be set to fosc if the above conditions are

summarized, and the frequency at the time of lamp stability lighting is set to fstb, by considering as fstb<fosc, at the time of starting, a discharge way can be formed certainly, starting voltage can be reduced, and there is usually effectiveness that a lamp can be made to turn on efficiently, at the time of lighting.

[0049] (Example 9) Examples 1-8 have shown the property of the electric-discharge lamp stabilizer contributed to the starting improvement of a lamp. the following -- as the 9th example -- a lamp -- it is said that it is related with a mouthpiece and an exclusive socket. a lamp -- the configuration of a mouthpiece can be constituted in right-and-left asymmetry, and a starting improvement can be more certainly made by making it the structure of going only into an exclusive socket. drawing 18 -- a lamp -- an example of a mouthpiece and drawing 19 are illustrating an example of a lamp socket. For four, as for heights and 6, a lamp pin and 5 are [ a lamp pin receptacle and 7 ] hollows among drawing. this example -- a lamp -- since the heights 5 for a lamp directivity judging are formed in one side of a mouthpiece and the hollow 7 for a lamp directivity judging is established in one side of the lamp socket of dedication corresponding to this, it can prevent inserting in an opposite direction certainly. thus, a lamp -- if the configuration of a mouthpiece constitutes in right-and-left asymmetry, the starting voltage impressed to the electrode of a side with the small resistivity of the electric-conduction film sets to V1 to touch-down potential by making it the structure go only into an exclusive socket and the resistivity of the electric-conduction film sets to V2 the starting voltage impressed to the electrode of a large side to touch-down potential, the conditions which impress starting voltage so that it may become |V1|>|V2| can carry out certainly.

[0050]

[Effect of the Invention] In the electric-discharge lamp lighting device which according to invention of claim 1 it has [ lighting device ] resistance along the direction of a discharge way in a tube wall, and the resistance distribution sees [ lighting device ] from a lamp longitudinal direction core, and makes an unsymmetrical lamp turn on with alternating voltage If resistivity sets to V1 starting voltage impressed to the electrode of a small side to touch-down potential and sets to V2 starting voltage with which resistivity is impressed to the electrode of a large side to touch-down potential | Since it was made to impress starting voltage so that it may become V1|>|V2|, the starting voltage of the lamp when seeing with peak pair peak value can be reduced, and proof-pressure reduction and a miniaturization of use electronic parts can be carried out.

[0051] Since a means by which make superimpose a dc component at the time of lamp starting, and it is impressed by the lamp voltage of an alternating current at it is provided according to invention of claim 2, even when using the ballast circuit which outputs an electrical potential difference symmetrical with positive/negative to a grand side, the effectiveness of this invention can be attained. According to invention of claim 3, since it was made to impress the height of starting voltage in alternation to a grand side, it can respond also at the time of lamp reverse insertion. Since a means to amend starting voltage according to the time of a lamp is provided according to invention of claim 4, even if resistance distribution of the electric conduction film of a lamp tube wall etc. changes with progress of a time, the startability ability of the time of the beginning of using is maintainable.

[0052] According to invention of claim 5, since the frequency at the time of lamp starting was set up more highly than the frequency at the time of lamp stability lighting, it can be made easy to lower the impedance of the distributed capacity between an electrode and a wall resistance at the time of starting, and to put into operation, and the impedance of the distributed capacity between an electrode and a wall resistance is made high at the time of stable lighting, and the bypass current which does not contribute to luminescence can be reduced. According to invention of claim 6, by making the configuration of the mouthpiece of lamp both ends unsymmetrical, insertion only in the direction with which are satisfied of the conditions of claim 1 is enabled, and the effectiveness of this invention can be attained certainly.

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[Translation done.]

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TECHNICAL FIELD

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[Field of the Invention] This invention relates to the electric-discharge lamp lighting device which carries out starting lighting of the fluorescent lamp with a conductive coat with alternating voltage.

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[Translation done.]

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## PRIOR ART

[Description of the Prior Art] Generally the consideration which a electric-discharge lamp lighting device restricts the output to a load for safety at the time of the abnormalities at lamp no-load and lamp incorrect insertion, a lamp filament open circuit, the time of the lamp end of life, etc., or is stopped is made. It receives unusually and the electronic formula stabilizer which consisted of especially electronic parts is implementing cures against protection, such as a quenching function and an intermittent oscillation function, often [ above ].
[0003] Drawing 20 is the circuit diagram of the conventional example (JP,9-153397,A). The rectifier DB with which this circuit carries out full wave rectification of the AC power supply, and the capacitor C2 connected to the outgoing end of Rectifier DB, The series connection of the switching elements Q1 and Q2 connected to the both ends of a capacitor C2, The series connection of the diodes D1 and D2 connected to the both ends of a switching element Q2, The series connection of the inductor L1 and smoothing capacitor C1 which were connected to the both ends of a switching element Q1 through diode D2, While consisting of series connection of the capacitor C3 connected to the both ends of a switching element Q2, an inductor L2, and the primary coil of a transformer T1 When the switching elements Q1 and Q2 of two stones repeat turning on and off by turns, it is the electric-discharge lamp lighting device which supplies the high-frequency power of the alternating current to the electric-discharge lamp 2 which is a load through the secondary coil of a transformer T1, and the capacitor C4 for a dc-component cut. moreover, in the circuit which consists of an inductor L1, a smoothing capacitor C1, and diodes D1 and D2 By supplying a current in the path of AC-power-supply -> rectifier DB-> inductor L1 -> smoothing capacitor C1 -> diode D2 -> switching element Q2 -> rectifier DB-> AC power supply at the time of ON of a switching element Q2 If a smoothing capacitor C1 is made to generate the charge electrical potential difference of a predetermined value and the output voltage of Rectifier DB declines from the charge electrical potential difference of a smoothing capacitor C1, the charge electrical potential difference of a smoothing capacitor C1 will serve as a power source of the inverter circuit which consists of a switching element Q1 and Q2 grade. That is, the circuit which consists of an inductor L1, a smoothing capacitor C1, and diodes D1 and D2 operates as the so-called partial smooth power source.
[0004] Moreover, the resistance R1 by which parallel connection was carried out among the non-power-source side edge children of a electric-discharge lamp 2, and resistance R2 and resistance R3 by which parallel connection was carried out to the both ends of switching elements Q1 and Q2 through the filaments f1 and f2 of a electric-discharge lamp 2, Resistance R1-R3 and IC1 which outputs a signal for the electrical potential difference determined by the filaments f1 and f2 of a electric-discharge lamp 2 to an oscillator circuit IC 2 as compared with reference voltage Vref are formed, and it has the configuration which performs no-load detection and filament open-circuit detection.
[0005] The actuation of this detector is as follows. Since a current flows from a power source in the path of the filament f2 -> resistance R2 -> resistance R3 of the filament f1 -> resistance R1 -> electric-discharge lamp of a electric-discharge lamp at the time of wearing of a normal electric-discharge lamp The electrical potential difference of resistance R1-R3 and the resistance R3 determined by the filaments

f1 and f2 of a electric-discharge lamp rises, it is setting up so that it may exceed reference voltage Vref in this condition, and IC1 outputs the signal of a low level to an oscillator circuit IC 2. An oscillator circuit IC 2 continues oscillation actuation of switching elements Q1 and Q2 in response to this signal. On the other hand, if at least one side of the filaments f1 and f2 of un-equipping or a electric-discharge lamp is disconnected by the electric-discharge lamp, since the current path to the above resistance R2 and R3 will be intercepted, the electrical potential difference of resistance R3 falls to abbreviation 0, that is, is less than the predetermined electrical potential difference Vref, and IC1 outputs a high-level signal to an oscillator circuit IC 2. An oscillator circuit IC 2 suspends oscillation actuation of switching elements Q1 and Q2 in response to this signal for protection of passive circuit elements, and performs quenching of switching elements Q1 and Q2. Here, if the charge shall be charged by the capacitor C4 for a dc-component cut, the current path of the secondary coil -> resistance R2 -> resistance R3 -> power source of the capacitor C4 -> transformer T1 for a power-source -> dc-component cut does not exist in it.

[0006] As mentioned above, in this conventional example, DC component by which the partial pressure was carried out through filament resistance and the resistance connected to the lamp at juxtaposition as a means to detect abnormal conditions, such as no-load [ of a lamp ] and an open circuit of a filament, has judged whether it is more than reference voltage. A filament disconnects this no-load detection method through both the filaments of a lamp, and effectiveness is very much to detect that DC current path was intercepted, and, generally it is used.

[0007] Drawing 21 shows the voltage waveform of a preheating and the lamp both ends at the time of making the light start and switch on for the lamp in the circuit of the conventional example. The electrical potential difference of the lamp both ends in this circuit has the description in the point that the electrical potential difference from a grand side serves as positive/negative asymmetry so that more clearly than drawing 21 . Since the oscillation electrical potential difference of an inverter is always overlapped on DC component for no-load detection at the time of a preheating, starting, and lighting, if lamp voltage of V0-p+ and a negative side is made into V0-p- for the lamp voltage by the side of forward [ of DC electrical potential difference on the basis of a ground plane ], the relation of |V0-p+|>|V0-p-| will be materialized inevitably. thus, the starting voltage of a lamp -- middle point touch-down -- receiving -- positive/negative -- when unsymmetrical, it is necessary to set up highly the starting voltage when seeing on the electrical potential difference Vpp from a peak (forward) to a peak (negative)

[0008] On the other hand, as for the latest lamp, starting voltage tends to rise for efficient-izing. That is, in order to make the latest efficient fluorescent lamp turn on satisfactory, ballast must impress an electrical potential difference low enough at the time of a preheating to a lamp, and must impress a very high electrical potential difference to a lamp at the time of starting. Generally, when starting voltage is high (i.e., if the oscillation electrical potential difference of ballast is high), there is an inclination for the electrical potential difference impressed at the time of a preheating to also become high. Therefore, this condition is narrowing the design tolerance of ballast and there was a problem of leading to a cost rise as a result.

[0009] This reason is explained below. First, the electrode of a fluorescent lamp is explained. This electrode attaches the matter called an emitter to a thin double coil-like (or triple coiled form) tungsten wire. This matter is for making electron emission easy to carry out, and current use of the barium oxide (a work function is low) etc. is carried out. the way of making carries out dipping of the thing of the shape of a slurry of a barium carbonate to an above-mentioned coiled form tungsten wire, and dries -- making -- lamp exhaust air -- the barium oxide is formed by heating in process -- making ($BaCO_3 \rightarrow BaO + CO_2$ : removal out of [ Exhaust air $CO_2$ is in process. ] a lamp) -- it says. The adhesion situation to the tungsten wire of the emitter matter attached to the electrode so that he can understand also from this process is not so powerful.

[0010] Next, the electron emission device of this electrode is explained. The current emitted from an electrode is expressed with a degree type.

$I = \text{alpha} * T^2 * \exp(-\text{beta}/T) * \exp(\text{rootE}/T)$

alpha: Constant beta related to an electrode material: Constant T related to an electrode material: Electrode temperature E: Field strength of the cathode drop section (it is related to a cathode drop electrical potential difference)

[0011] As shown also in this formula, the discharge current is determined on electrode temperature and a cathode drop electrical potential difference. If electrode temperature is low that is, in order to supply a current at the time of starting as a preheating is inadequate, a cathode drop electrical potential difference will rise. A rise of a cathode drop electrical potential difference increases the kinetic energy of ion (supplied by the cathode drop electrical potential difference) in case ion collides to an electrode. It becomes impossible for this reason, to disregard the effect of the ion bombardment to an electrode.

[0012] As mentioned above, how to the electrode of an emitter to attach is not so strong. Therefore, if a cathode drop electrical potential difference rises, an emitter will exfoliate from a tungsten wire by the impact of the ion. There is a problem that this becomes a short life in order to decrease the emitter currently attached to the tungsten wire while causing the melanism of the electrode section of a lamp. In order to prevent this, it is required to warm enough, before putting an electrode into operation.

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[Translation done.]

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## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the microscopic wave form chart of the lamp voltage in the example 1 of this invention.
[Drawing 2] It is the microscopic wave form chart of the lamp voltage in the example of a comparison over this invention.
[Drawing 3] It is the circuit diagram of the example 2 of this invention.
[Drawing 4] It is the circuit diagram of the example 3 of this invention.
[Drawing 5] It is the macroscopic wave form chart of the lamp voltage in the example 4 of this invention.
[Drawing 6] It is the macroscopic wave form chart of the lamp voltage in the example 5 of this invention.
[Drawing 7] It is the microscopic wave form chart of the lamp voltage in the 1st section of the example 5 of this invention.
[Drawing 8] It is the microscopic wave form chart of the lamp voltage for explaining actuation of imbalance control of the switching duty used for the example 5 of this invention.
[Drawing 9] It is the microscopic wave form chart of the lamp voltage in the 2nd section of the example 5 of this invention.
[Drawing 10] It is the microscopic wave form chart of the lamp voltage in the 3rd section of the example 5 of this invention.
[Drawing 11] It is the macroscopic wave form chart of the lamp voltage in the example 6 of this invention.
[Drawing 12] It is the explanatory view showing secular change of the lamp wall resistance in the example 7 of this invention.
[Drawing 13] It is the macroscopic wave form chart of lamp voltage showing change of the starting voltage after the long duration progress in the example 7 of this invention.
[Drawing 14] the structure of the lamp with a conductive coat which is an adaptation lamp of this invention is shown -- it is a fracture front view a part.
[Drawing 15] It is the explanatory view showing the starting mechanism of the lamp with a conductive coat which is an adaptation lamp of this invention.
[Drawing 16] It is the representative circuit schematic of the lamp with a conductive coat which is an adaptation lamp of this invention.
[Drawing 17] It is the property Fig. showing resistance distribution of the lamp with a conductive coat which is an adaptation lamp of this invention according to each company.
[Drawing 18] the lamp used for the example 9 of this invention -- it is the front view showing the structure of a mouthpiece.
[Drawing 19] It is drawing showing the structure of the lamp socket used for the example 9 of this invention, and (A) is a front view and (B) is a sectional side elevation.
[Drawing 20] It is the circuit diagram of the electric-discharge lamp lighting device of the conventional

example.

[Drawing 21] It is the wave form chart showing the lamp voltage at the time of starting of the electric-discharge lamp lighting device of the conventional example.

[Description of Notations]

1 Electric-discharge Lamp Lighting Device

2 Lamp with Conductive Film

3 Starting Amendment Circuit

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## EFFECT OF THE INVENTION

[Effect of the Invention] In the electric-discharge lamp lighting device which according to invention of claim 1 it has [ lighting device ] resistance along the direction of a discharge way in a tube wall, and the resistance distribution sees [ lighting device ] from a lamp longitudinal direction core, and makes an unsymmetrical lamp turn on with alternating voltage If resistivity sets to V1 starting voltage impressed to the electrode of a small side to touch-down potential and sets to V2 starting voltage with which resistivity is impressed to the electrode of a large side to touch-down potential | Since it was made to impress starting voltage so that it may become V1|>|V2|, the starting voltage of the lamp when seeing with peak pair peak value can be reduced, and proof-pressure reduction and a miniaturization of use electronic parts can be carried out.
[0051] Since a means by which make superimpose a dc component at the time of lamp starting, and it is impressed by the lamp voltage of an alternating current at it is provided according to invention of claim 2, even when using the ballast circuit which outputs an electrical potential difference symmetrical with positive/negative to a grand side, the effectiveness of this invention can be attained. According to invention of claim 3, since it was made to impress the height of starting voltage in alternation to a grand side, it can respond also at the time of lamp reverse insertion. Since a means to amend starting voltage according to the time of a lamp is provided according to invention of claim 4, even if resistance distribution of the electric conduction film of a lamp tube wall etc. changes with progress of a time, the startability ability of the time of the beginning of using is maintainable.
[0052] According to invention of claim 5, since the frequency at the time of lamp starting was set up more highly than the frequency at the time of lamp stability lighting, it can be made easy to lower the impedance of the distributed capacity between an electrode and a wall resistance at the time of starting, and to put into operation, and the impedance of the distributed capacity between an electrode and a wall resistance is made high at the time of stable lighting, and the bypass current which does not contribute to luminescence can be reduced. According to invention of claim 6, by making the configuration of the mouthpiece of lamp both ends unsymmetrical, insertion only in the direction with which are satisfied of the conditions of claim 1 is enabled, and the effectiveness of this invention can be attained certainly.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] Drawing 17 shows resistance distribution of the lamp which has each lamp manufacturer's conductive coat. Resistance distribution of a conductive coat looks at the lamp by A company make and B company from the location based on lamp longitudinal directions, it is greatly unsymmetrical, and the resistance of the tubing edge by the side of the manufacturer mark on the front face of a lamp is low, and the resistance of the tubing edge of the lamp of a mark and the opposite side is very high. Resistance distribution of a conductive coat looks at the lamp by C company make and D company from the location based on lamp longitudinal directions, it is asymmetry a little, and its resistance of lamp both the tubing edge is high, and it serves as distribution with a low center section. As for such a difference, each company originates in the difference in a production process. Although the lamp with a conductive coat has a difference by each manufacturer, it can be said that resistance distribution is unsymmetrical seen from a longitudinal direction core. With such a lamp, starting voltage serves as positive/negative asymmetry.
[0014] however -- the copper-iron stabilizer of a conventional type -- starting voltage -- positive/negative -- an unsymmetrical lamp -- receiving -- positive/negative -- there was no means to control whether it is made to start with which polarity, and since it was the sine wave of a commercial frequency, positive/negative [ say / |V0-p+|=|V0-p-|=| lamp starting voltage | ] needed to impress the big electrical potential difference of the amplitude to the lamp inevitably.
[0015] This invention is made in view of such a point, and the place made into the purpose is to reduce the starting voltage seen with peak pair peak value, unsymmetrical-izing starting voltage of a electric-discharge lamp lighting device to a lamp with unsymmetrical starting voltage, and maintaining startability ability.

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DRAWINGS

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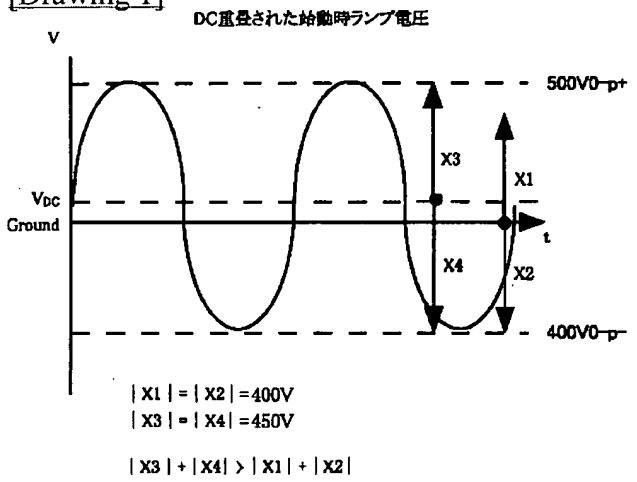
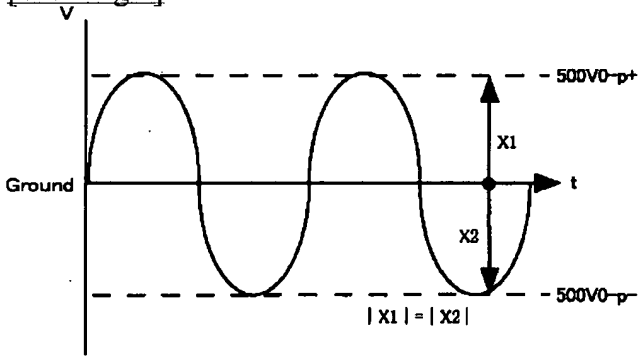
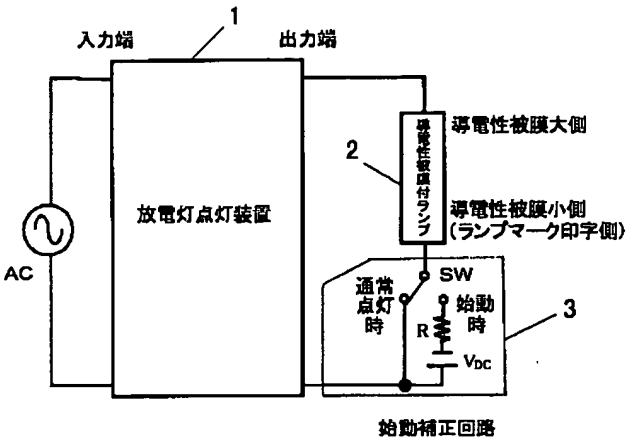
[Drawing 1]



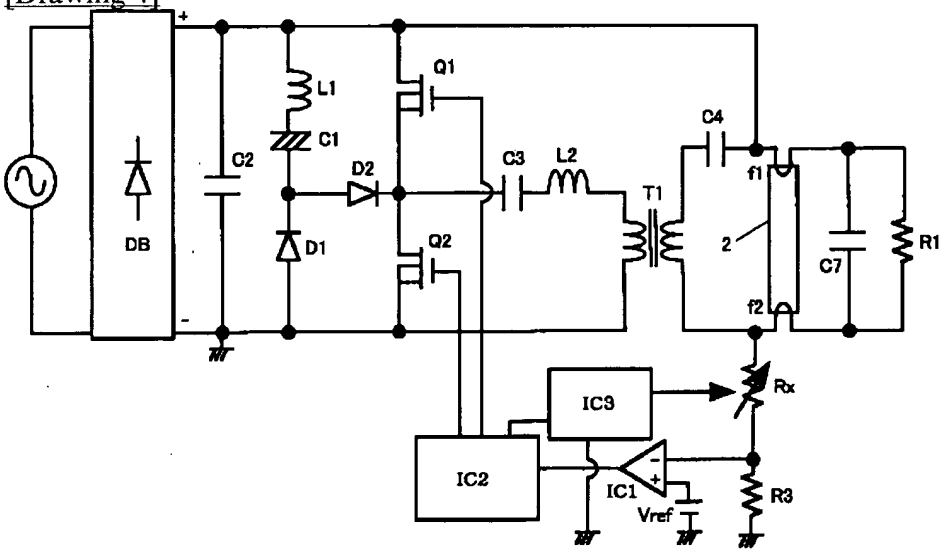

[Drawing 2]



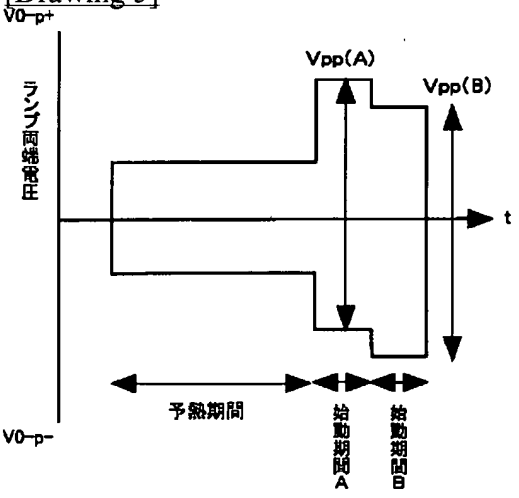

[Drawing 3]



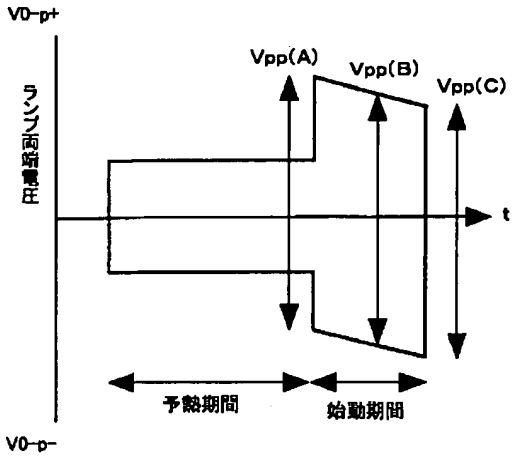

[Drawing 4]



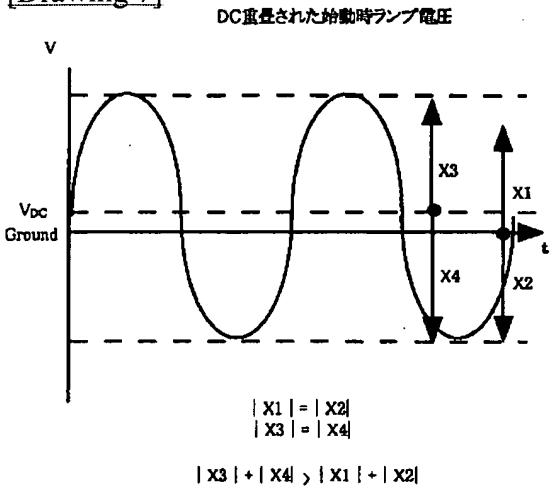

[Drawing 5]



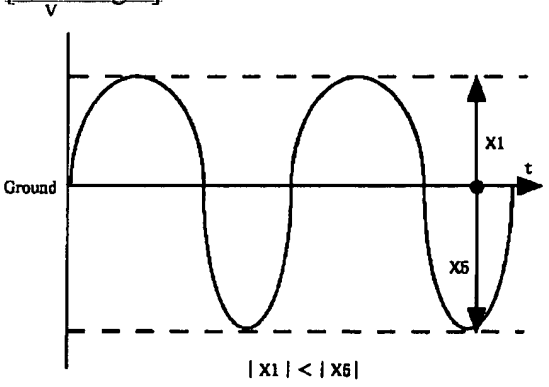

[Drawing 6]



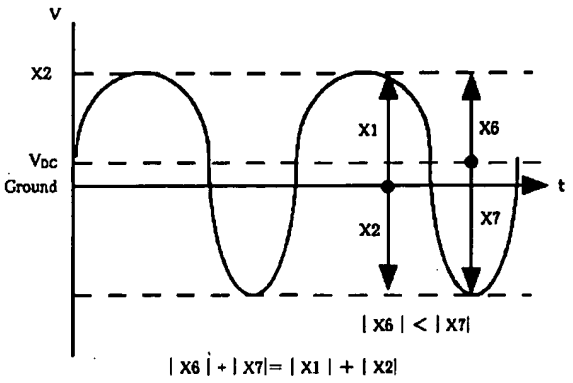

[Drawing 7]



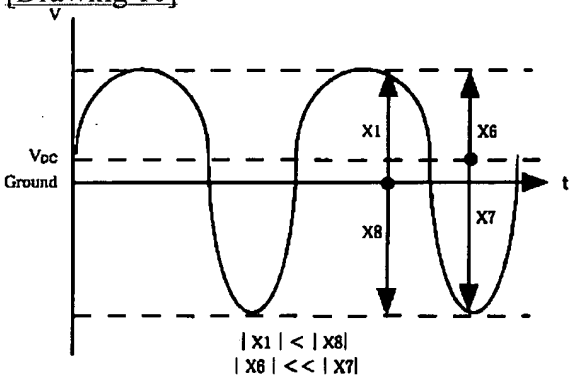

[Drawing 8]



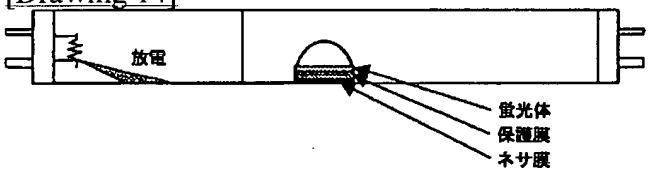

[Drawing 9]



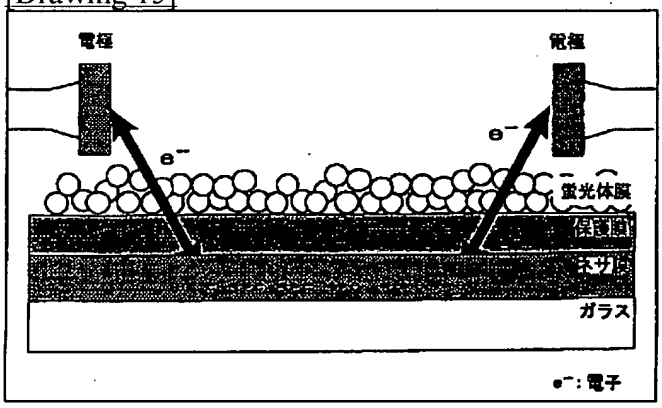

[Drawing 10]



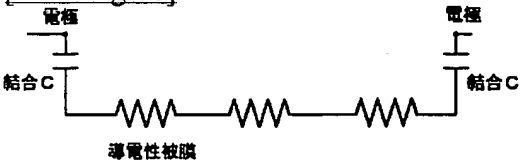

[Drawing 14]



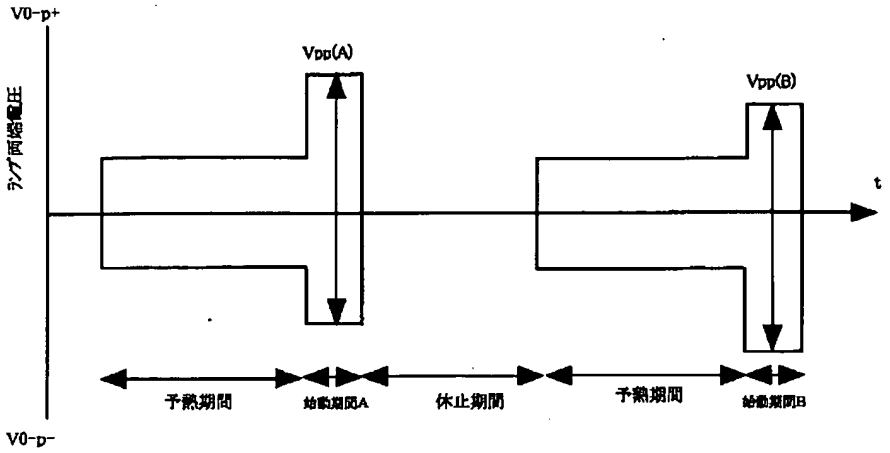

[Drawing 15]



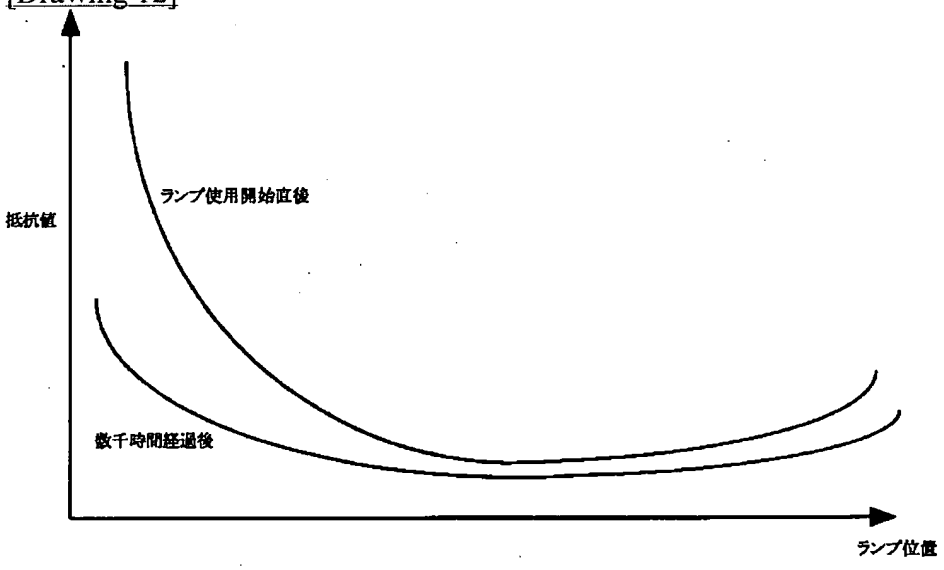

[Drawing 16]



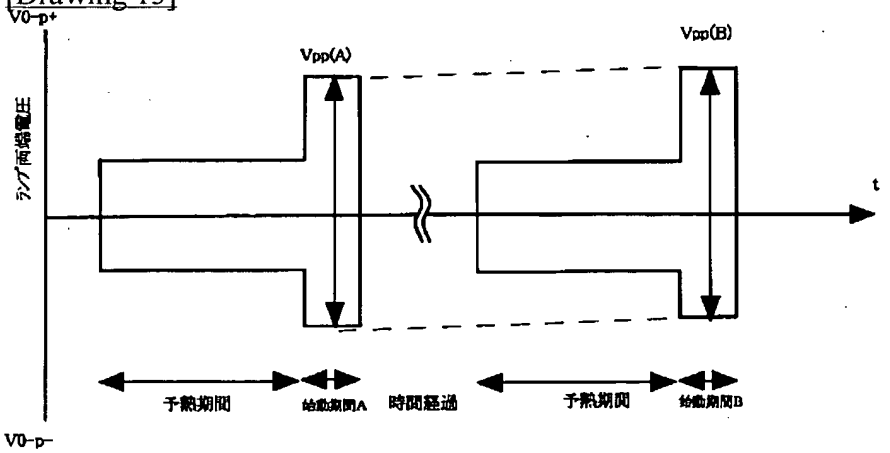

[Drawing 11]



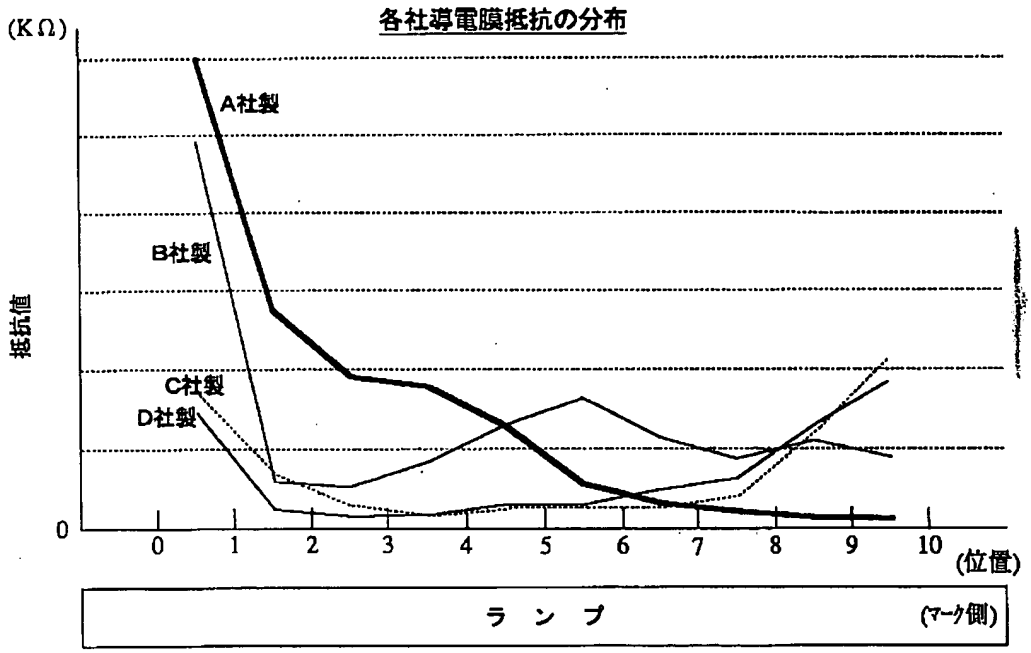

[Drawing 12]



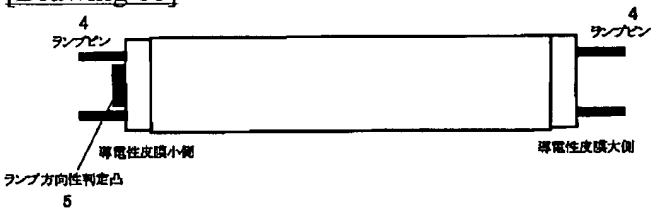

[Drawing 13]



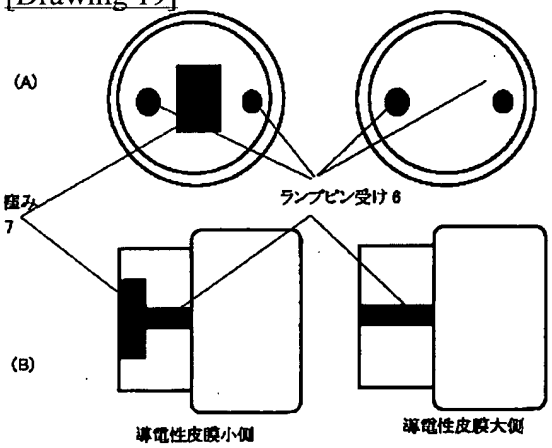

[Drawing 17]



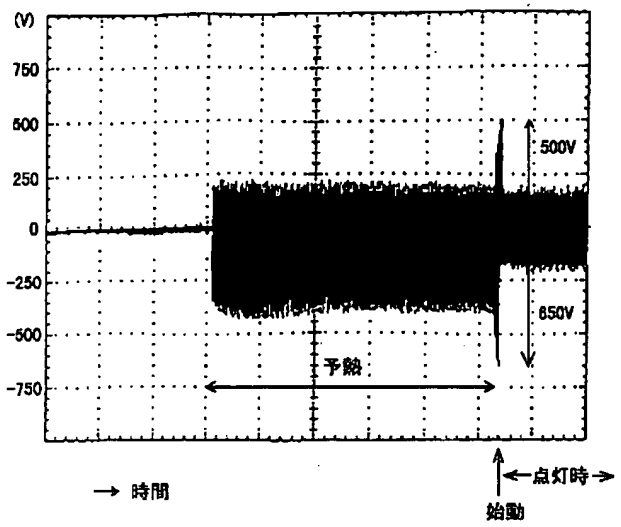

[Drawing 18]



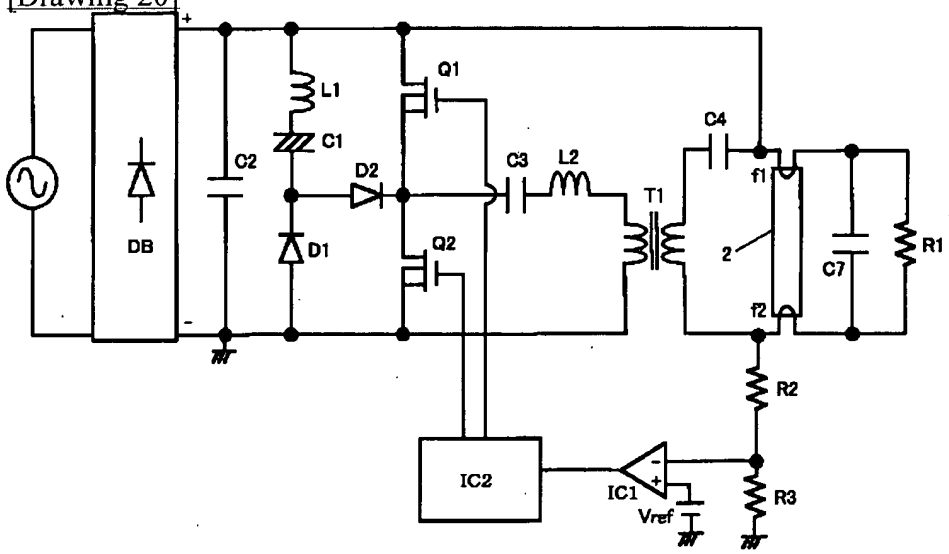

[Drawing 19]




[Drawing 21]




[Drawing 20]




[Translation done.]